Homework 1

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ex1)
We assume that in this Neural Network that there is a hidden layer and an output layer. The Hidden layer will contain 2 nodes. The preactivation function will transform the values. Once the ReLU function is used, it will create a pair of $\{(0,0),(0,0)\}$ for the first 2 pairs and forthe other it $\{(1,0),(0,1)\}$. These new values can easily be linearly seperable.
ex4)

	X_1	X_2	Y
a_0	-1	-1	-1
a_1	1	1	-1
a_2	1	-1	1
a_3	-1	1	1

(1)

We know to linearly seperate the points we use the equation $\vec{w}_{i+1} = \vec{w}_i + \alpha * y * a_i$.We use this equation to iterate through until there is no change of the $\vec{w}$.
The Starting $\vec{w}$ is $\{0,0\}$ with an $\alpha = 1$
Step 1)

$$\begin{aligned} \vec{w}_1 &= \vec{w}_0 + \alpha * (-1) * a_0 \\ &= \{1,1\} \end{aligned} \tag{1}$$

Step 2)

$$\begin{aligned} \vec{w}_2 &= \vec{w}_1 + \alpha * (-1) * a_1 \\ &= \{2,2\} \end{aligned} \tag{2}$$

Step 3)

$$\begin{aligned} \vec{w}_3 &= \vec{w}_2 + \alpha * (-1) * a_2 \\ &= \{3,1\} \end{aligned} \tag{3}$$

Step 4)

$$\begin{aligned} \vec{w}_4 &= \vec{w}_3 + \alpha * (1) * a_3 \\ &= \{2,2\} \end{aligned} \tag{4}$$

Step 5)

$$\begin{aligned} \vec{w}_5 &= \vec{w}_4 + \alpha * (-1) * a_0 \\ &= \{1,1\} \end{aligned} \tag{5}$$

Step 6)

$$\begin{aligned} \vec{w}_6 &= \vec{w}_5 + \alpha * (-1) * a_1 \\ &= \{2,2\} \end{aligned} \tag{6}$$

After a few Cycles, we see $\vec{w}$ does not converge, but oscillates. This is because these points can not be linearly seperated.